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jected to constant change and correction without any material improvement.

The most aggravated cases of such failure may be observed in persons who are incapable of sustained effort in any direction.

The effect of apperception upon the character must not be overlooked. Habitual, thorough apperception of experiences, together with careful reflection upon the same,—during which reflection higher apperception must take place,—insures clear insight, steadfast, reliable judgment, and effective, well-timed action.

Some one has said that all the mistakes in the world arise from insufficient observation. Perhaps we may say more correctly that all the mistakes in the world arise from insufficient or incomplete apperception.

The man who apperceives is the man who delays judgment until he can relate his new experiences to the mass of known products that are similar to the new. Having brought the new product into its right relations with the whole, he is able to pronounce upon it correctly and with authority.

The power to relate correctly, and to judge accurately, imparts stability to the character, and secures that organic firmness, suppleness, subtlety, adaptability, and individuality, which we call culture. Such culture secures its possessor against awkwardness, or embarrassment, and enables him to meet all emergencies with tranquility and repose.

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PSYCHOLOGY AND PEDAGOGY

If the relationship of psychology and pedagogy is not a burning question, it is at least a phosphorescent question. We meet it everywhere. The department of pedagogy in universities has courses in psychology, the instructor at Teachers' Institutes has his lecture on psychology, and the educational journals, even those for public school teachers, have

their psychological corners. Books and booklets, treating of these alliterated ologies, pour from the press ; and grave philosophers predict that the application of the science of the mind is going to work a revolution in pedagogy.

Yet there are, after all, a few teachers who hold themselves sceptical towards the new movement. Some have read no psychology at all and have done well without it ; others have tried to read elaborate texts on the subject, but have failed to understand them ; others again have read and understood, but have been unable to find the point of application. "What is pedagogical psychology ?" said the inquirer to the sceptic. "pedagogical psychology," replied the sceptic, "is a text book of psychology and a text book of pedagogy bound together." Certain it is, that a treatise like "Sully's Outlines of Psychology" lends some color to the reply of the sceptic, for at the end of every chapter, on psychological questions, there are a few pages of pedagogy ; the substance of which is the same as the contents of a text, devoted exclusively to the practical side of education.

If, now, we seek the motif, the original impulses of the sciencing of pedagogy, we shall find that there are two :
1. The scientific spirit of our age. Science has done so much for our material welfare by its electricity and bessemer steel ; it has done so much for our intellectual welfare by its exploitations of the heavens above and the earth beneath ; it has done so much for our spiritual welfare by its rout of the spirits of darkness and of dread, of superstition and sciolism, that it has completely infatuated us, and we follow it blindly and regardlessly. The exactness of the mathematical law of relative proportions in chemistry and of falling bodies in physics we would introduce into art, into literature, into morals, and into education.

2. The confusion of "common observation" with science. Every science has its beginnings in common observation, and in its developed stages carries along with its body of recondite principles a large pendant of facts of common observation. Ig-

nited wood burns when air is supplied. Saliva dissolves the starchy elements of food. These are chemical facts of common observation. Water runs up an exhausted tube. Heat expands metal. These are physical facts of common observation. Exercise develops the muscles. The point of distinct vision is about ten inches from the eye. These are physiological facts of common observation. A man has two arms, a fish two fins, a bird two wings. These are anatomical facts of common observation. "No two minds are alike,"—which an eminent advocate of psychology in education gravely tells us we learn from psychology,—attention facilitates learning. These are psychological facts of common observation. Now if we examine closely, the pedagogical psychology of the day, we shall find that most of it is built upon the facts of common observation rather than upon the abstruse principles of psychology.

Pursuing the method of exclusion, and eliminating from psychology all the subjects that are conceded to have no bearing upon pedagogy, we shall find that we have only the thinnest and the scrawniest science left. Take perception, for instance, and of the multitude of questions treated thereunder, it is save to assume that none of them have any direct bearing upon pedagogy. True it is that without perception there cannot be knowledge and without a modicum of time, there cannot be distinct perception, but these again are facts self-evident to every one who understands the terms. Consider the localization of sensation: how it is that a prick of a pin when transferred to the sensorium and there changed into a spiritual entity, a fact of consciousness without place, direction, length, breadth, or thickness, should be given a local habitation on the finger, and thus assigned a definite space relation. Take the whole question of space; how our space concept is built up, how we estimate distance, how we determine the direction of a sounding or luminous body, how we project the sensation of light or sound to its objective origin, feet, yards, miles, distant from us.

Take the distinction between sensations and perception and Weber's Law of the discrimination of sensations ; all of these subjects are treated elaborately in psychology, and yet, none of them can be made of practical application in teaching. The teacher, then, who goes to psychology for direct assistance in his specialty, shall find, after his exhaustive study of perception, that he is a wiser psychologist, but a no more sagacious teacher. But perception does not exhaust the list of subjects that fail to grip the question of teaching. The freedom of the will, the reality or phenominality of the internal world, dreams, sonambulism, hallucination, thought transference, hypnotism, and the localization of the brain functions, all of these subjects are important and of singular interest, but their orbit is as separate and distinct from the orbit of teaching as it is from the orbit of the signs of the zodiac.

Other important psychological topics are: the order of the development of the faculties, the relation of the mind and body, the attention, the will, the imagination, and the association of ideas. If now we study these subjects in any pedagogical psychology, we shall find that what is available and useful in them for the teacher is—with one exception—based on common observation rather than scientific psychology. Thus we are told, in an approved text, that the whole system of training should conform to the natural order of the development of the faculties. The value of this statement, however, is destroyed by the declaration immediately following it, that it is a self-evident proposition. Now the order of the development of the faculties, as laid down by psychologists, is ; 1, sensation, 2, perception, 3, imagination, 4, conception, 5, judgment, 6, reasoning. The pedagogical value of this order of the development of the faculties will be seen to be nil, if we bear in mind the fact, that long before the child appears in the school room, he is a perceiving, imagining, conceiving, judging, reasoning little animal, and that the first three days of his life are given up entirely to the senses is a rather shiftless fact in the premises.

It may be said, indeed, with a fair degree of exactness, that in the early school life, the faculties develop *pari passu*. The child is taught the qualities of objects, perception; he is asked to talk, to narrate, imagination; he is required to define, conception; he is taught numbers, abstraction—a phase of conception; he is encouraged to draw lessons from stories, reasoning. Here then in the very first months of school life are six faculties to be appealed to and to be developed.

At the basis of all knowledge and all development lie sensation and perception, the building material. The hortation, then, that the child must be taught things, which has been somewhat overvaunted as a valuable contribution of psychology to teaching is, after all, a mere induction from common observation. It is a product of sense rather than of psychology. Every mother teaches her child colors and elemental forms, and not Euclid and algebra. She spares it discussion of original sin and of the *summum bonum*, and lets it look at the light and play with its rattle. If the elaborate system of Froebel with its gifts, and its plays, and its nuances, be adduced as perceptive contributions to education, it is to be answered that the excellence of the system does not depend upon its conformity to psychology, but on its conformity to pedagogy, and that it is no more psychological, no less psychological, than the answer to the anxious mother's question: "When is the best time for my boy to begin a trade?" The fact of the matter is, that every sensible parent and teacher wittingly or instinctively acts upon the principle of multiplying sensations—of imparting knowledge—and leaves the question of direction and emphasis, and generalization, to be determined by (1), the character of the individual child's mind, and 2, the probable exigencies of its practical life, and these are disclosed by direct observation of every particular case and not by general psychological laws. That the output of this psychologic mine is altogether uncertain, is shown by the very words of the psychologists themselves. "The problem," to quote from one of them,

‘when to take up the subjects requiring a considerable measure of abstraction, such as the physical sciences, grammar, and so on, is one of the most perplexing ones in the art of education.’ If no universal rule can be obtained, then we are really left where we were at the beginning; with a series of cases, each to be treated on its own merits.

Let us now examine for a moment the psychology of attention, and we shall find as before that whatever is applicable to teaching is a matter of common observation, an induction of common sense. We are told that the voluntary attention of a child is rudimentary and that its task must be made attractive; that there must be a change of occupation, as the interest in one subject soon flags. All this is very good and very true, but it is constantly employed by mothers and teachers, who do not know what psychology means. Children are given a variety of playthings, they are assigned short lessons, they have fewer hours in school, they are shown pictures, they are given object lessons; all based upon the recognition—oftentimes instinctive—of the weakness of their power of attention. □

The attempt of a distinguished writer in the Nov. No. of the *Ed. Review* to apply some of the subtleties of recent investigations in attention to the usufruct of teaching, altogether misses the mark, for it is not the esoteric subtlety that is helpful but the exoteric principle, just as it is not the pattern of our coat that keeps us warm, but the material of it. In recent years, a number of interesting experiments have been made upon what has been called reaction time; *e. g.*, the time that elapses between the outward stimulation—the strike of a bell or the flash of a light—and the recognition of it as such. This time has been found to be from one-eighth to one-fifth of a second, varying somewhat with the different senses and with the strength of the impression; a loud noise, a bright light, shortening the reaction time. It has been further shown that where the impression is looked for, where the attention is tense and expectant, then the reaction time can be reduced to a practical null. All of these measurements are of profound

interest to our psychologists, but when the above named writer exclaims, "How rich in pedagogic suggestions is the fact brought to light in these researches, that when the mind is beforehand poised or focused for a particular impression, the process of clear apprehension is reduced to minimal limits of time," we must demur—demur because the rich suggestions open out in a commonplace, as his very next sentence shows, "May not all teaching be said to accomplish its purpose by exciting the favorable attribute of expectancy."

Now this is an apt instance of the futility and the inutility of so much of pedagogical psychology. Here is a long and labored deduction of a perfectly patent principle of pedagogy—no knowledge without attention. Every teacher knows that no boy can learn his spelling or his multiplication table, while he is swapping jack knives, nor his reading while he is either agent or receiver in the matter of sticking pins. To make this principle in any way dependent on reaction time is simply to darken counsel with words, and to these interpreters of the ways of psychology to pedagogy, the weary teacher may say with Job: "You are all physicians of no value."

Again the correlation of mind and body, however interesting a subject for study and investigation, is not fruitful in pedagogy. The teacher may not know that fatigue is due to the exhaustion of certain cerebral centres, but he does know that the weary child learns with great difficulty. He knows, too, that by threats and promises fatigue can be temporarily overcome, and the child thus constrained or enticed to learn, and this knowledge is neither strengthened nor weakened by the further knowledge that the threat, the promise, stimulate the nerve centres to a temporary additional activity. Though he may not know the epigram of Feurbach: "Der Mensch ist was er isst," "Man is what he eats," he does know that insufficient and innutritive food weakens the mental powers, and that he is not to expect the same intellectual and volitional accomplishments from the starvling of the slums that he expects from the healthy boy of the well-to-do burgher.

The only subject that is fruitful to education is "Association of ideas." This is the common ground of pedagogy and psychology. The line that connects the sciences is an unbroken one, differing only in breadth and shading. Thus chemistry blends into physics in chemical physics, and physiology and chemistry in physiological chemistry, and so in the association of ideas, the science of psychology passes over into the art of teaching.

The turning, then, of so many psychologists to the subject of education will hardly bring about the revolution in scholastic affairs that Prof. Carveth Read has promised us. The melancholy fact is, that up to this time, the revolutions in education have been wrought by the philistine rather than by the philosopher. The philistine it was, who drove out the old education with its Latin verse and "elegant imbecility"—to quote Sydney Smith—and established in its place the elective system, the school of technology, the school of history and political science, the manual training school, and the industrial school. Much can yet be done to improve methods, and contributions should be welcomed from philosopher and philistine, yet after all, the richest gifts must come from those who work in education as an art rather than study it as a science.

With "The Association of Ideas" embodied in a text book of pedagogy, the teacher would have all the psychology that would be of practical avail to him. That the study of psychology would make him a broader man and a stronger man is a matter of course, but so would a study of physics. The fact of the matter is that every liberal education—meaning thereby the power to orient oneself in the world—must include chemistry and physics which explain the fundamental principles of matter, and psychology, which explains the fundamental processes of the soul. But as one can build a roaring fire without knowing that the approximate formula of wood is $C_{18} H_{30} O_{15}$, that the air is a mixture and not a compound in proportion of one part oxygen to four nitrogen ;

that oxygen unites with the constituents of the wood only at and above such a degree centigrade, that the products of combustion are CO_2 , H_2O and pure carbon, and finally that the combustion of wood is merely a specific case of chemical action; so one can teach a child to read by any or all of the approved methods, and can teach it geography with the story and with the moulding board, without knowing the order of the development of the faculties, nor Berkeley's Theory of Vision, nor Lotze's Local Sign, nor Ferrier's Localization of the Brain Function, nor Wundt's Measurement of Reaction Times.

That psychology has disciplinary value only and that the point of direct application to teaching can hardly be found is seen in almost every article bearing upon pedagogy. In the instructive series of articles recently running through "The Forum," by Dr. J. M. Rice, on the public schools of the United States, there is persistent bewailment of the absence of instruction in psychology and pedagogy for the teachers in the public schools. He quotes with commendation the remark of a New York teacher that owing to the complete mechanization of the public school system of New York she could not apply the psychology she had learned at the normal school. Yet when Dr. Rice does find a school where there is freedom and spontaneity of action, the illustrations of excellent work he adduces are invariably from pedagogy, never from psychology. In short, they are tricks of the trade. Take for illustration the article on The Public Schools of Boston. He writes with approval of the George Putnam School, at Roxbury, and describes one or two admirable features. "Another interesting feature of the school, and one that acts as a stimulant to keep alive what the pupils have learned, is what Mr. Clapp calls, 'random recitations.' The last twenty minutes of some of the recitation hours are devoted to these 'random recitations,' which are conducted by the scholars. Four subjects are usually taken up, five minutes being devoted to each, the pupils being allowed

to ask each other any question that they are supposed to be able to answer. After one of the pupils has asked two or three questions he appoints another to take his place. During the 'random recitations' the class is full of life and enthusiasm. I found the children very quick and generally well informed. While these recitations are going on, the teacher sits by and takes no part other than keeping the children from going astray."

And again after describing some indifferent work in another school, he writes: "These lessons stand in marked contrast to the geography lesson given in my presence by Miss Rich, the first assistant of the Dwight School, which was one of the best geography lessons I ever attended. The recitation was upon Africa. Geography and history were beautifully interwoven, the pupils were full of ideas, and the enthusiasm throughout the lesson was great." Now the secret of this superior work lies in the words: "Geography and history were beautifully interwoven;" and they resolve into three elements, which are no more psychological, no less psychological than the lawyer's plea before a jury, or a clergyman's sermon at a revival meeting. They are: 1. History and geography are mutually illuminative; 2. Clever literary workmanship; 3. The magnetic temperament.

Pestalozzi is probably responsible for the introduction into education of the nomenclature of psychology. Kant's "Pädagogik," and Pestalozzi's "Wie Gertrud ihre Kinder lehrt," appeared about the same time. Great as Kant was, both as a teacher and a philosopher, yet the word psychology scarcely appears—if, indeed, at all—in the "Pädagogik." Slight as Pestalozzi was as a philosopher, yet he never seems easy until he has reduced every pedagogical method to a fundamental psychological principle. The reduction is oftentimes factitious and spurious, yet it satisfies Pestalozzi's desire for unity and for a scientific basis for his work. Singular it is that, if the connection between psychology and pedagogy is so close, it should

have escaped the greatest philosopher of modern times. Probably Kant was right.

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COMMUNICATION

To the Editor of the School Review :

In a book review written for the April number of the *SCHOOL REVIEW*, mention was made of a solution of the equation $\sqrt{2x+8} - 2\sqrt{x+5} = 2$ in which $+4$ and -4 were regarded as roots. This solution was criticised on the ground that neither $+4$ nor -4 will render the equation in its present form an identity. The review has called forth some letters of enquiry as to why these answers are objectionable and what method of solution will give the correct roots, if any roots are to be found.

There are very few even of our best algebras that give a comprehensive treatment of equivalent equations, yet a clear idea of their nature and importance is necessary to an understanding of algebra as a science. Very often, to be sure, algebra is taught as an art rather than as a science; but even as an art, algebra loses much by not considering the equivalence of equations. Some of the ordinary methods of solving algebraic problems are likely to introduce or eliminate one or more roots, and so we frequently find that the answers to problems given in some text-books in common use are incorrect, that is, when these answers are substituted for the unknown quantity, they will not satisfy the original equation. Especially is this true of equations containing surds.

It has been proved that every rational integral equation has a root; and, also, that the number of roots of every such equation corresponds to the degree of the equation. Thus, an equation of the second degree has two roots. In all the realm of real and imaginary numbers, there are to be found two quantities, and two only, that will satisfy any given equation